



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

The Principles of Mechanics. By HENRICH HERTZ. Authorized English Translation by D. E. JONES and J. T. WALLEY. Macmillan & Co., London, 1899.—pp. xxviii, 276.

The MSS. of the *Principles* was sent to the publishers by the author shortly before his death (Jan. 1, 1894), and the book appeared in that year under the supervision of Dr. Philipp Lenard. An excellent English translation has now been made; but the philosophic public not already acquainted with the work has probably been deterred by its technical contents rather than by the foreign idiom. The reviewer may then be permitted to say a word about the author's purpose and its historical significance.

The motives governing the development of mechanics prior to Newton are straight-forward, being directed toward fixing the 'dimensions' of the science and formulating axioms from which any problem of nature completely stateable in terms of these dimensions could be solved. But Newton having apparently achieved this end, it is not so clear what problems he bequeathed to his successors, save those of deduction.

These problems could doubtless be presented in more than one way, but the following will serve to exhibit the motives of a writer like Hertz. (1) Newton's definitions were inadequate, in particular those of his new 'dimension,' *mass*, and of his extended concept of *force*. (2) There were alternative ways of attacking problems for which different principles served as starting point: Was the ground of choice a subjective estimate of fitness, or was there an objective difference in generality? In particular, it was a question whether the fundamental axiom should be stated as a law of *force*, as a law of *work*, or in some other way. For the range of problems discussed by Newton it was plain that these alternatives were objectively equivalent, but it did not remain so in the light of efforts to complete Newton's efforts in a third direction. (3) Newton himself entertained the ideal of making the axioms of mechanics sufficient for the solution of *all* natural problems. This implies the statement of the problem in terms to which Newtonian laws of motion can be applied. But when the attempt is made to reconstruct the wealth of phenomena of modern physics in terms of mass particles influencing each other according to such laws, we are lost in clouds of hypotheses—the apparent simplicity of the conception disappears. Even if we cling to the 'image' of a system of particles producing in each other mutual accelerations, it is doubtful whether we should be permitted to restrict these to such as take place along lines of junction and are dependent only on the momentary distribution (not, *e. g.*, on the momentary velocities) of the particles. In view of these difficulties, it is a question as to whether it would not be simpler to give up the Newtonian 'image,' resting on the concept of action-at-a-distance, and so to reconstruct our physical and mechanical problems that we can state them as though masses only influenced each other by means of 'rigid connections.' Even taking this to be merely a descriptive term, it is evident that it requires an extensive working over of mechanical method—and this is part of Hertz's

task. In this connection too the question of throwing our fundamental law into a 'work' or 'energy' rather than a 'force formula' becomes important. Our powers of prediction of natural phenomena in terms of such formulæ as Hamilton's Principle outstrip our ability to deduce the results from the 'image' of Newtonian forces. For although the 'transformation of energy' view supposes the amount of energy to be measurable in mechanical work, yet we do not have to translate this equation of amounts into terms that show a likeness of kind before we can predict results: the *Zustandsbestimmungen* that lead to a soluble physical equation are broader than the mechanical dimensions. Of course the reduction of physical processes to 'mass-motions' may still be made; in the meanwhile a formula which has at least a quantitative meaning in physics and offers a complete description of mass-motions where problems are set in terms of these, has the preference. (4) Finally Newton's laws of motion are not stated in a single formula. Although it is not always easy to say what makes a formula 'single,' it *is* easy to understand the æsthetic value of such 'conservation' and 'minima' formulæ as have been suggested to replace the Newtonian 'laws.'

Without following Hertz's order of treatment, the reviewer has tried to set forth the chief motives that have impelled modern students of mechanics to work from the transformation of energy point of view, and some at least to abandon the concept of action-at-a-distance. Hertz himself goes a step further. A difficulty, he feels, lies in introducing the concept of energy in its most general form at the very first stage of our development. How define it, if we have set aside the Newtonian order of procedure in which work and energy presuppose the independent definition of force? It is this consideration that leads him to set up a new axiom modeled after the various integral formulæ, but in which the 'dimensions,' space, time, and mass, appear singly or in easily definable combinations. This axiom is embodied in the statement: "Every natural motion of an independent material system consists herein, that the system follows with uniform velocity one of its straightest paths. . . . The law condenses into a single statement the usual law of inertia and Gauss's Principle of Least Constraint." (p. 27.)

As to the influence of Hertz's Principles upon the contemporary treatment of mechanics, it would appear that most writers are content to follow Helmholtz's example in waiting for time to prove its utility. It is noticeable, however, that Helmholtz himself, in his *Vorlesungen üb. d. theoretische Physik* (1898), goes to the extreme in treating 'rigid connections' within a system as special cases of internal forces, which, for convenience and with approximate correctness only, may be supposed absolutely to prevent distortion. Hertz is at some pains to show that the question at issue here is one of fact (pp. 40 ff.). The reviewer is of the opinion that the point deserves the attention of metaphysicians as a significant and clear-cut problem in scientific method. For the rest, the Introduction to the *Principles* offers

splendid material to the student of method, who is interested in the history and fate of axioms.

E. A. SINGER, JR.

Introduction a la vie de l'esprit. Par LEON BRUNSCHVIGG. Paris, Alcan, 1900.—pp. 175.

The preface and table of contents of this volume give so clear an indication of its purpose, that they may well be quoted. "Philosophy," we are told, "is the methodical reflection of the spirit upon itself." It therefore "demands only the inner witness of the thinking being," and "is accessible to every man who brings to it attention, so that an exposition of it suffices" (*il suffit qu'elle soit exposée*). In pursuance of this plan, Professor Brunschvigg briefly outlines what is virtually a system of idealistic philosophy.

The first chapter on "The Conscious Life" is a compact and able little summary of psychological doctrine, upon a somewhat shifting basis. Many assertions, like the definition of spirit (pp. 37, 46) as a "totalité des idées," indicate a Humian foundation of Braunschvigg's psychology; but the underlying tendency of the discussion is toward the treatment of psychology as a doctrine of the activity of spirit, whose distinguishing functions are analysis and synthesis.

The second chapter, treating of "The Scientific Life," is the least satisfactory of the book, but this is not surprising when one remembers that the idealist is usually, though not necessarily, least successful in his discussion of nature philosophy. The total lack of any consideration of causality is the most curious feature of the book; the definition of space as "relation of exteriority" is a mere tautology; the doctrine of time as succession lacks any reference to the connection between time and causality; and, finally, the teaching that time, like space, is a form of the outer world is in obvious opposition to the assertions of the book itself that the conscious life is a succession of ideas.

The latter chapters are the best of the book, direct, graceful, and often effective in style, and alive with what the author calls "la fécondité morale." The æsthetic life is defined, after the manner of Schopenhauer, as "the unity of the spirit with the object of its contemplation," and a consequent "interruption of the individuality." This loss of individuality in the æsthetic experience is, however, distinguished, with fine discrimination, from personal sympathy in which "we preserve all our will and subordinate it to that of another"; whereas in the æsthetic appreciation of the characters of fiction "we are Hamlet, Bérénice, Eugénie Grandet—we disappear to become other selves." It is through this interruption of the individuality, the author teaches, that "beauty transforms the soul which has created it" and that "sympathy is born within us." "Without doubt," he adds, "the sympathy born of beauty is . . . a platonic and inactive admiration, almost a form of egotism, yet it is none the less a necessary in-